

International



Synthetic Biology

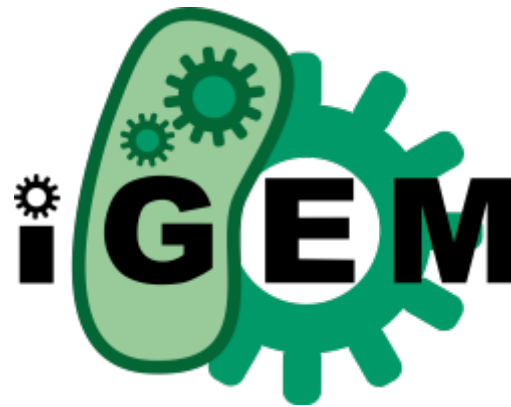


Teamwork and
Collaboration



Competition





International



Synthetic Biology



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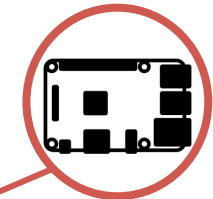
Competition



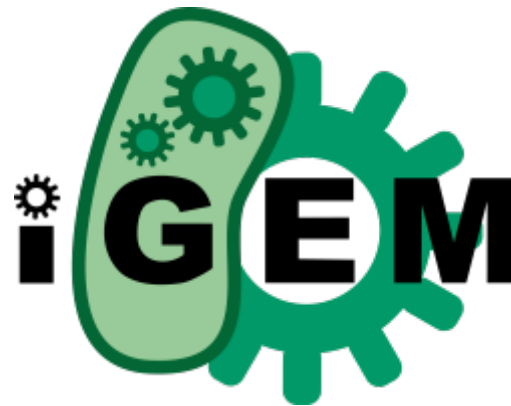
Software



Biology



Hardware



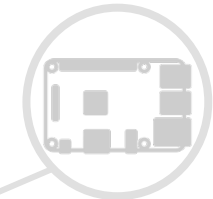
International



Software

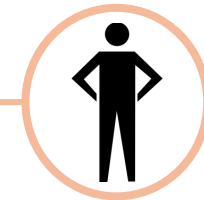


Biology

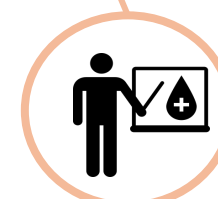


Hardware

Human Practices



Open source



Education

Synthetic Biology



Teamwork and
Collaboration



Competition



What is Synthetic Biology?



Bananish ?



Kiwange?

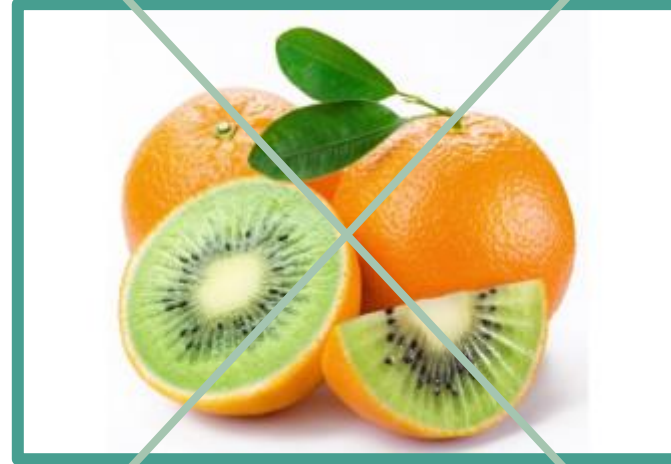


Zebaroo?

What is Synthetic Biology?



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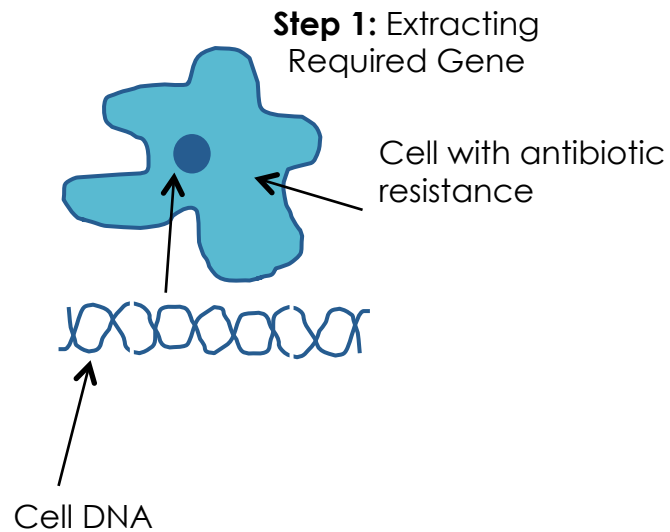
Zebaroo?

What is Synthetic Biology?

Definition: The design or redesign of new or existing biological parts, devices and systems for useful purposes.

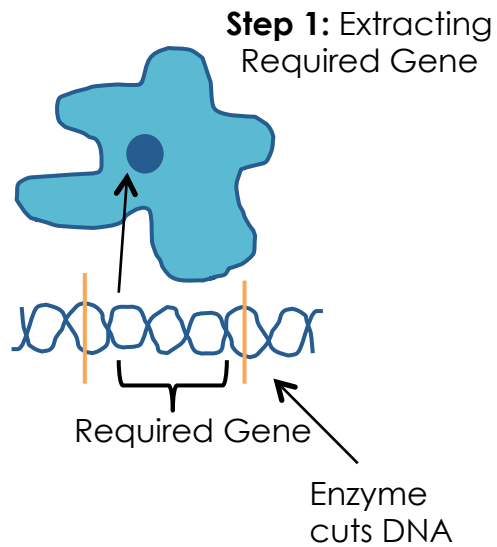
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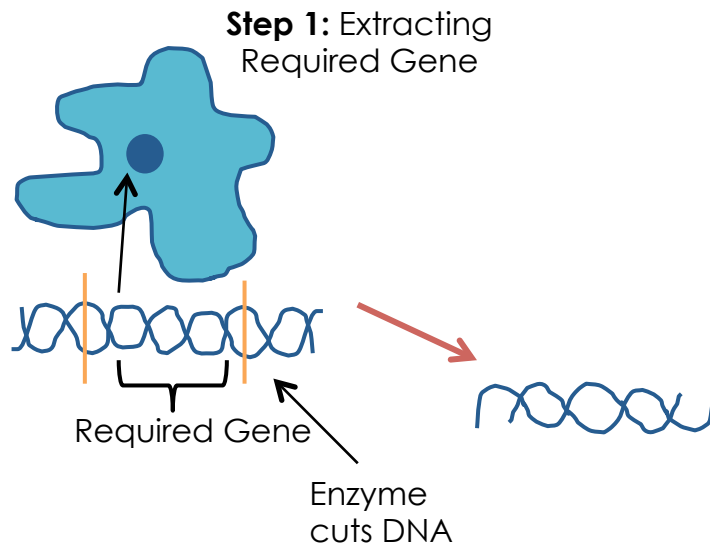
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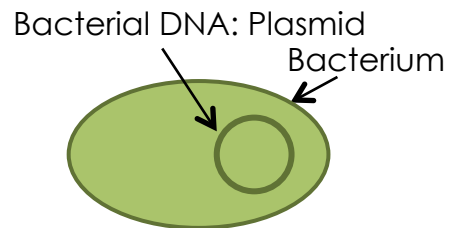
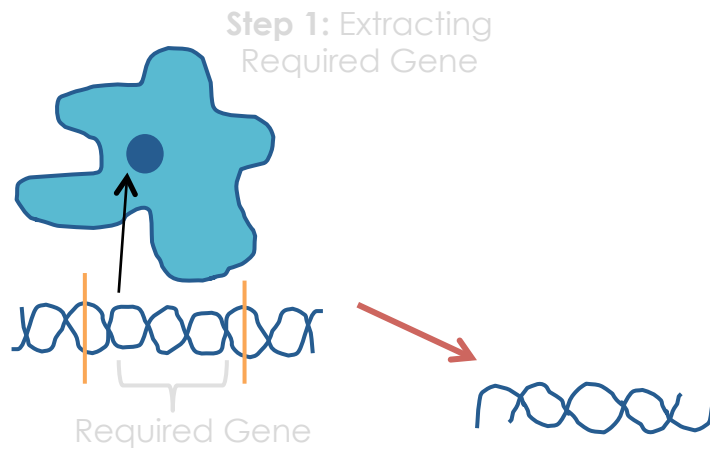
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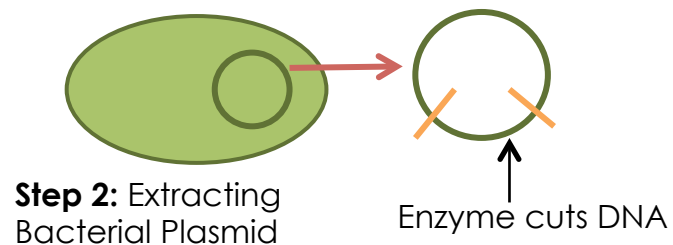
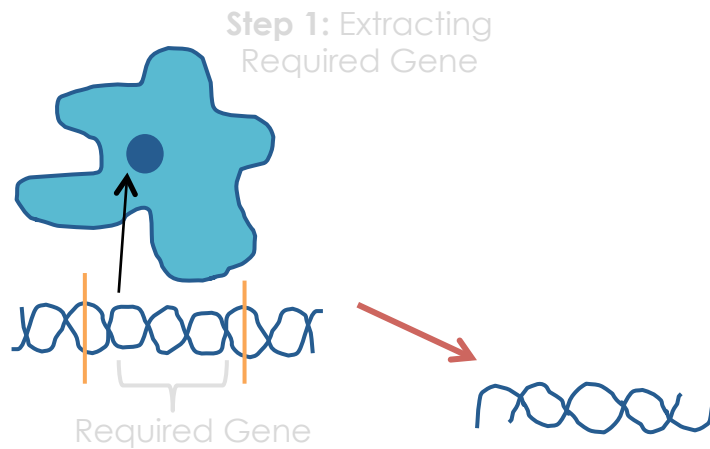
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Step 2: Extracting Bacterial Plasmid

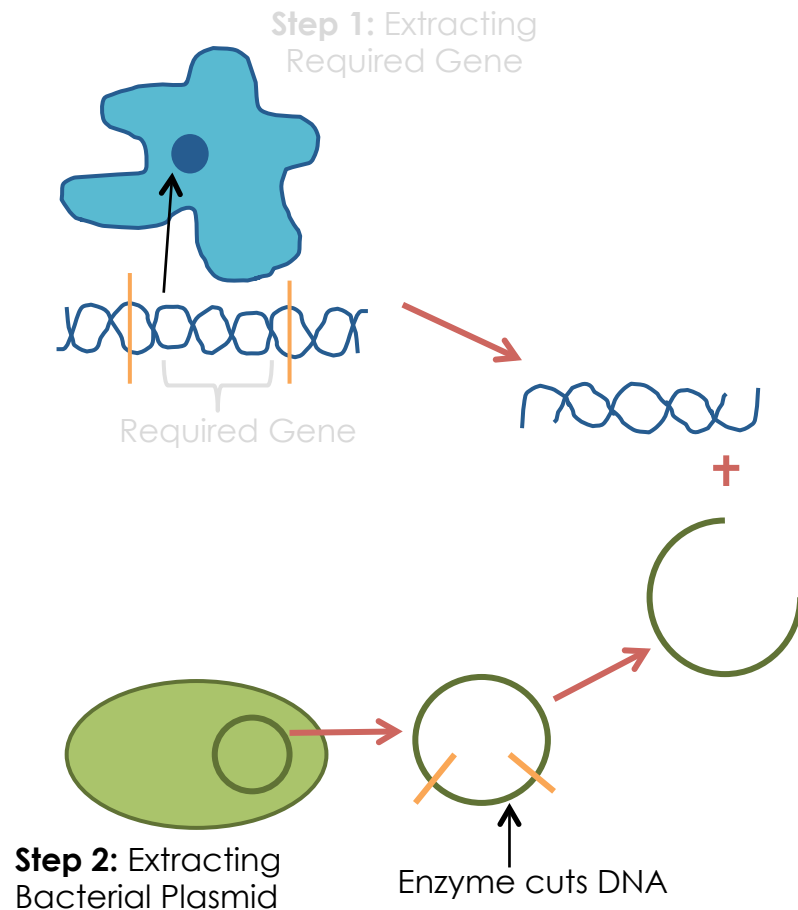
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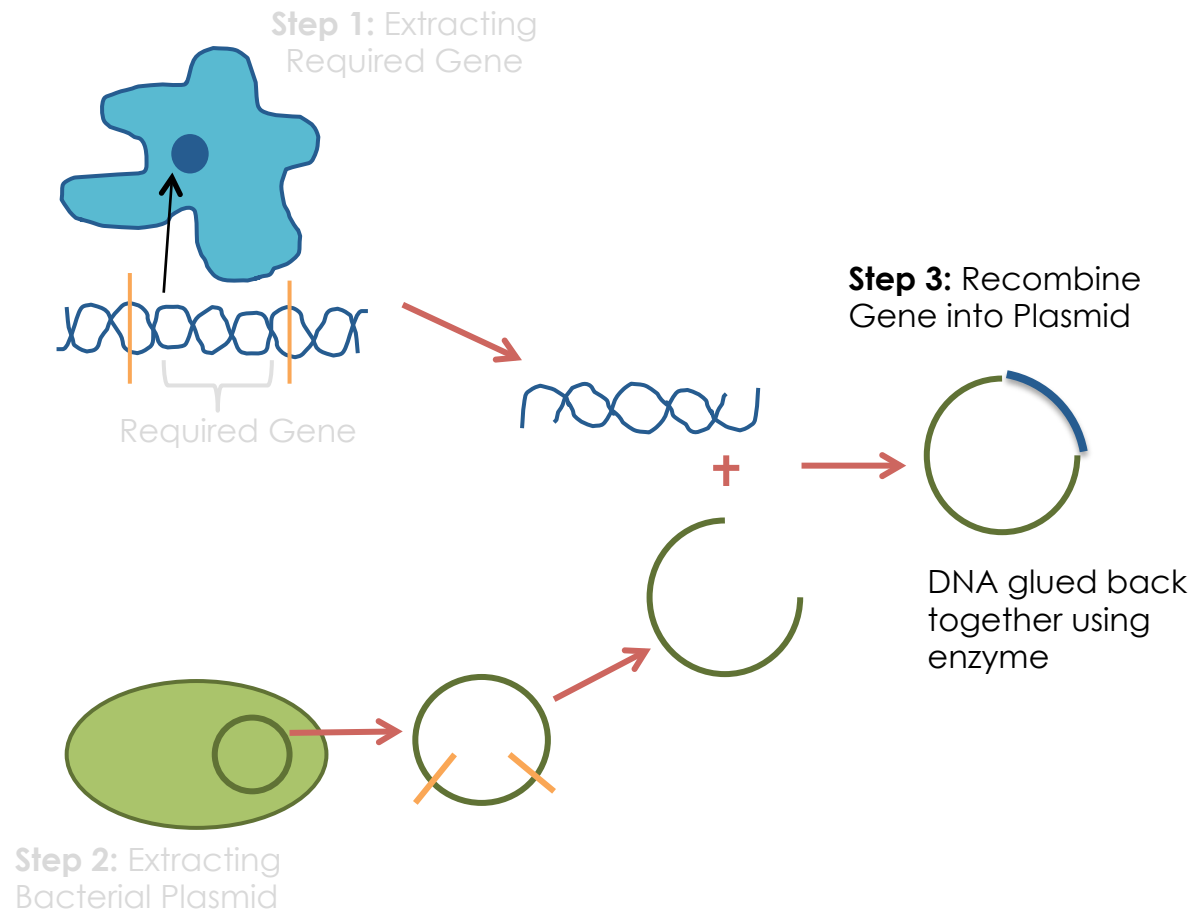
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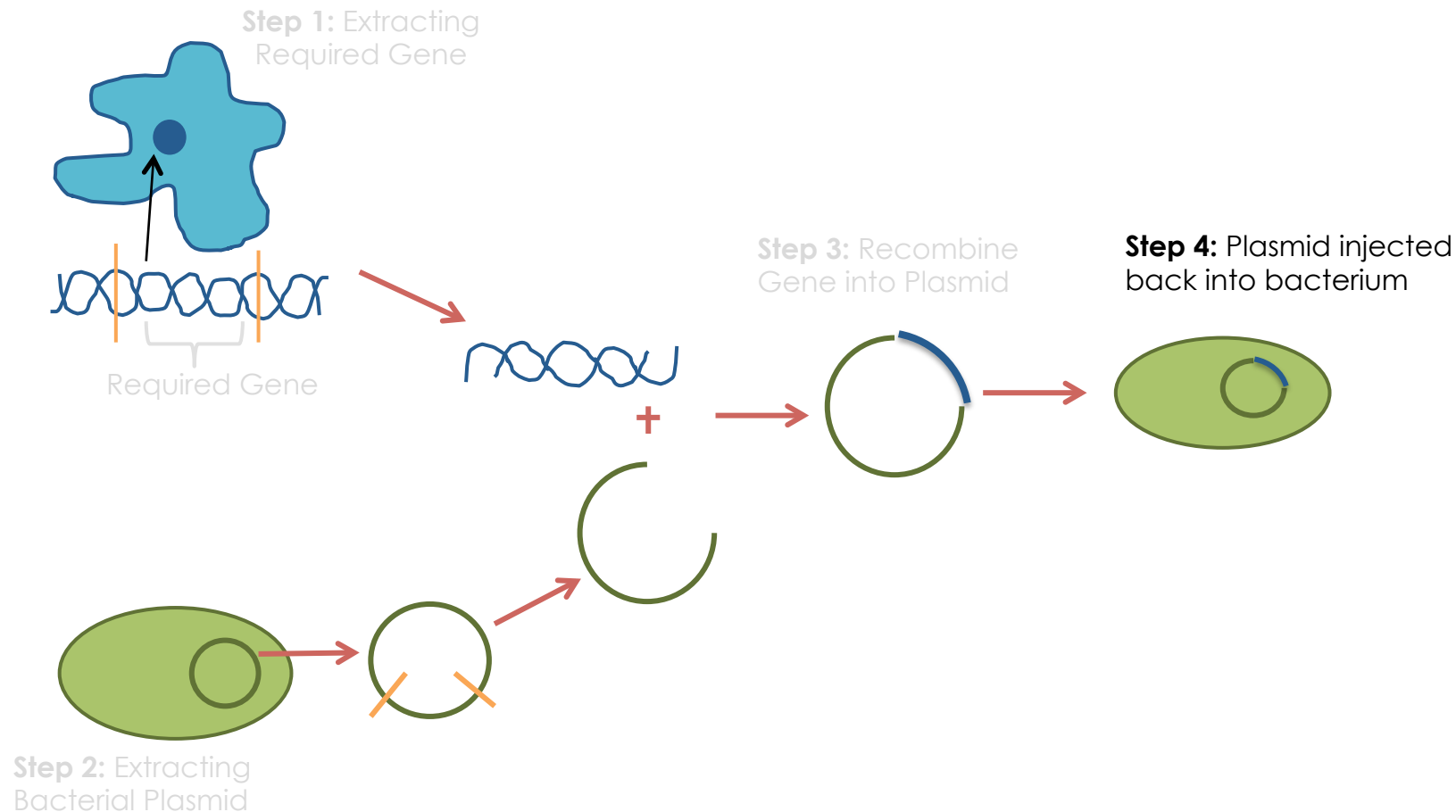
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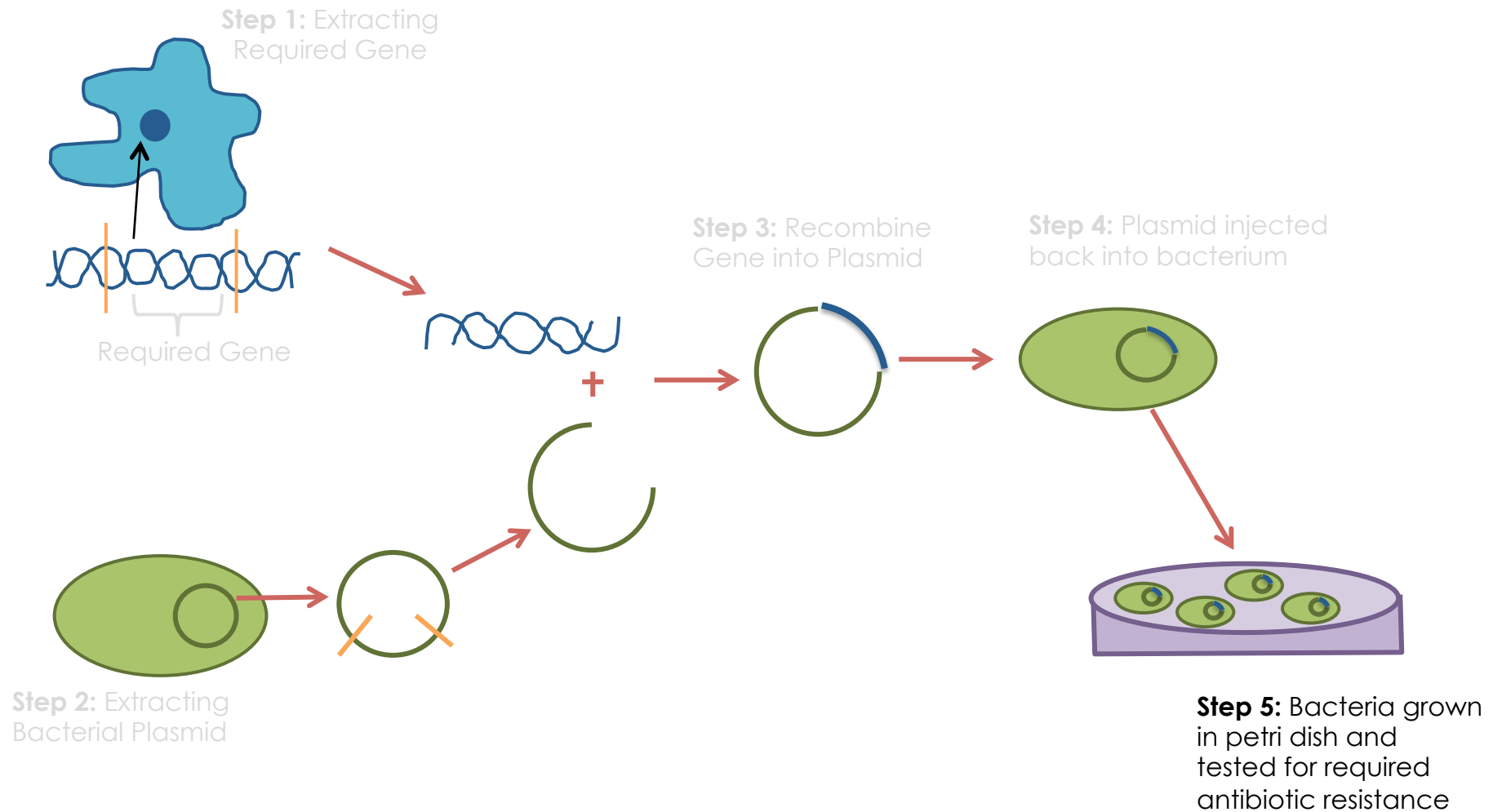
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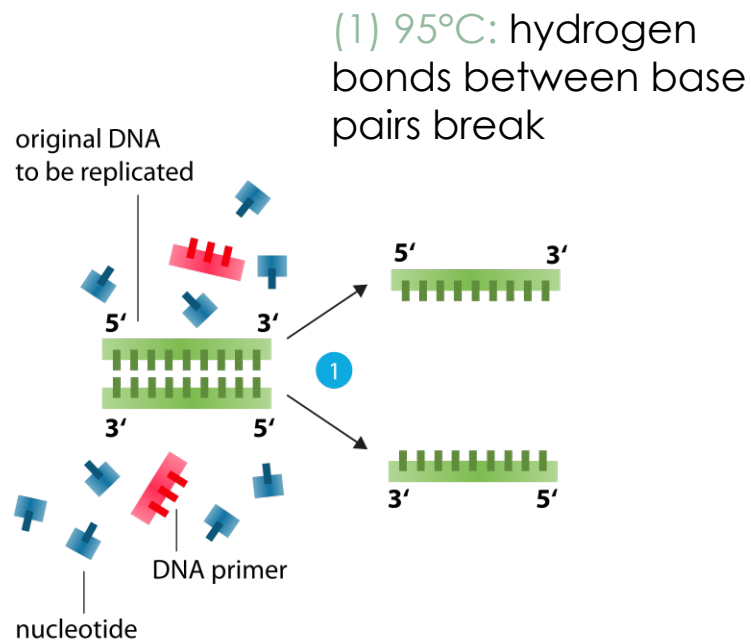
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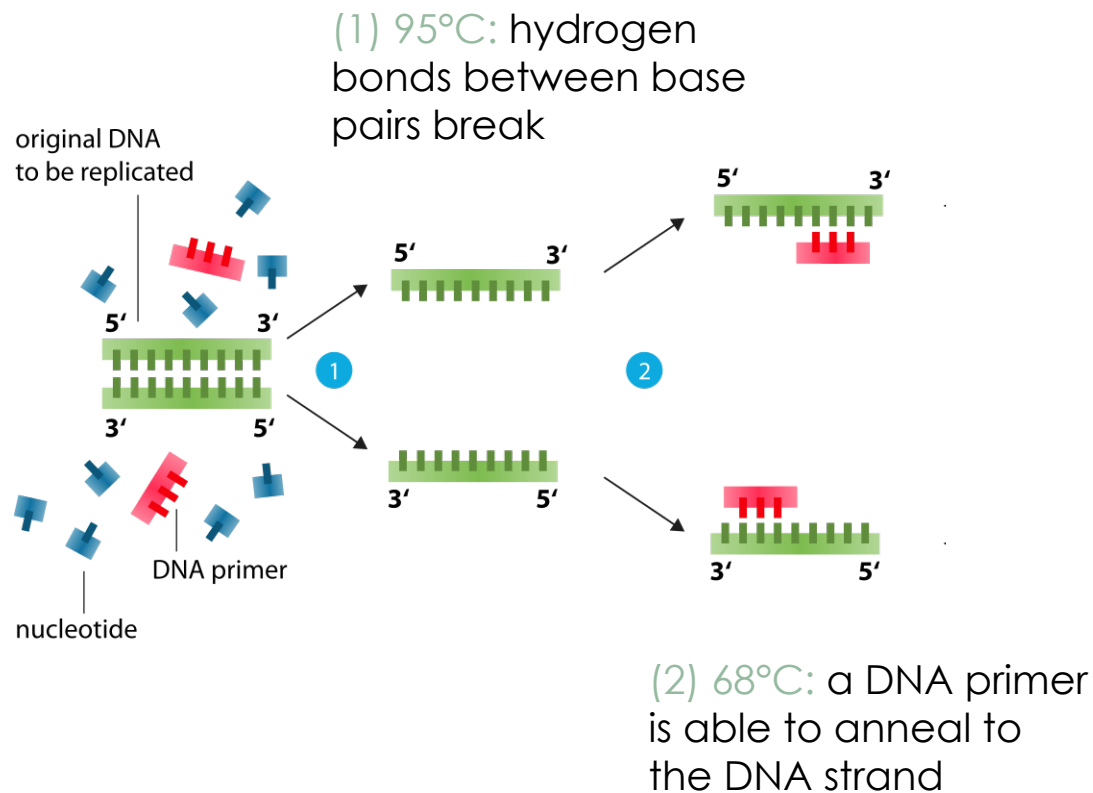
How is this done on a larger scale: PCR

PCR (Polymerase Chain Reaction): Process by which a single piece of DNA is replicated to produce millions of copies.



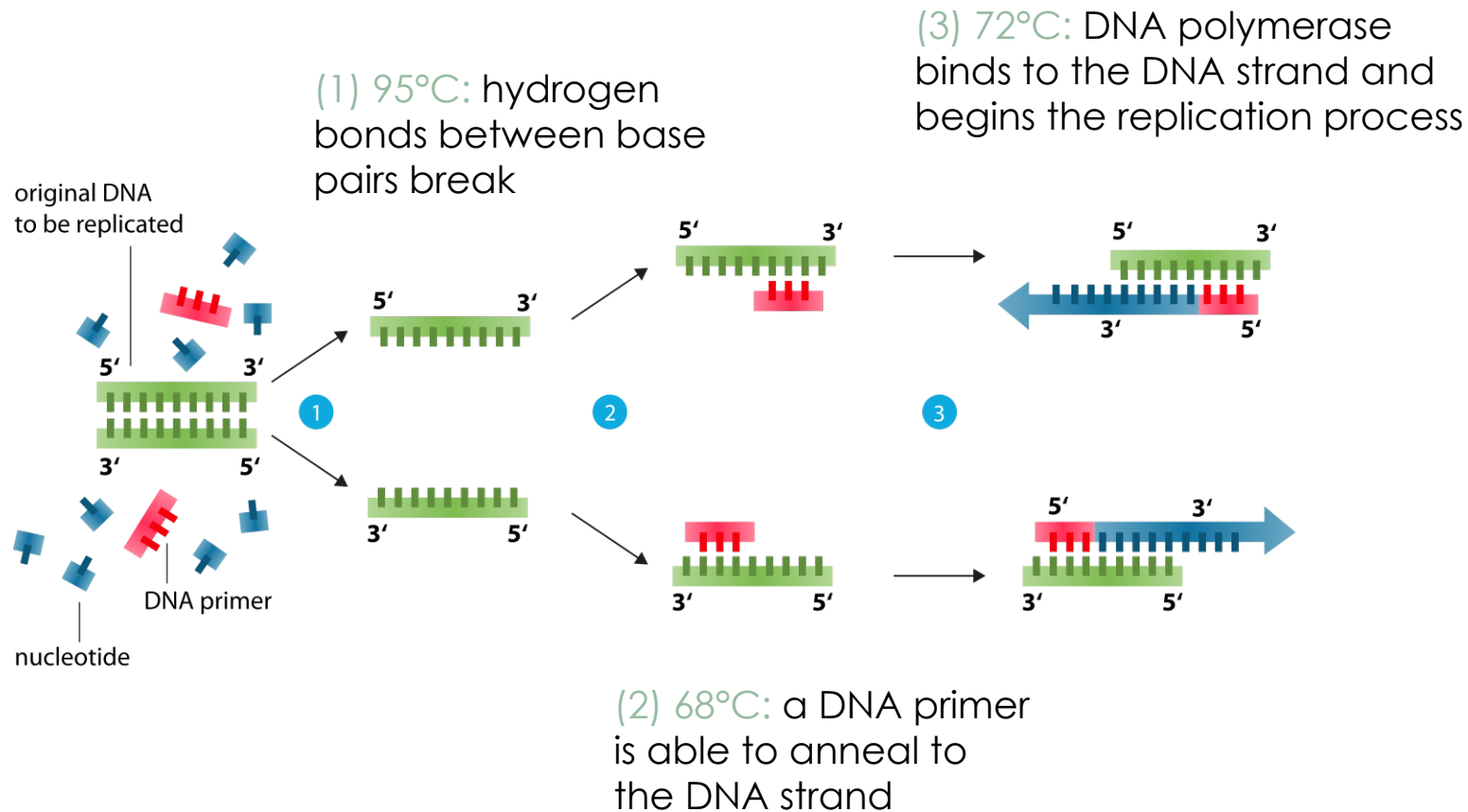
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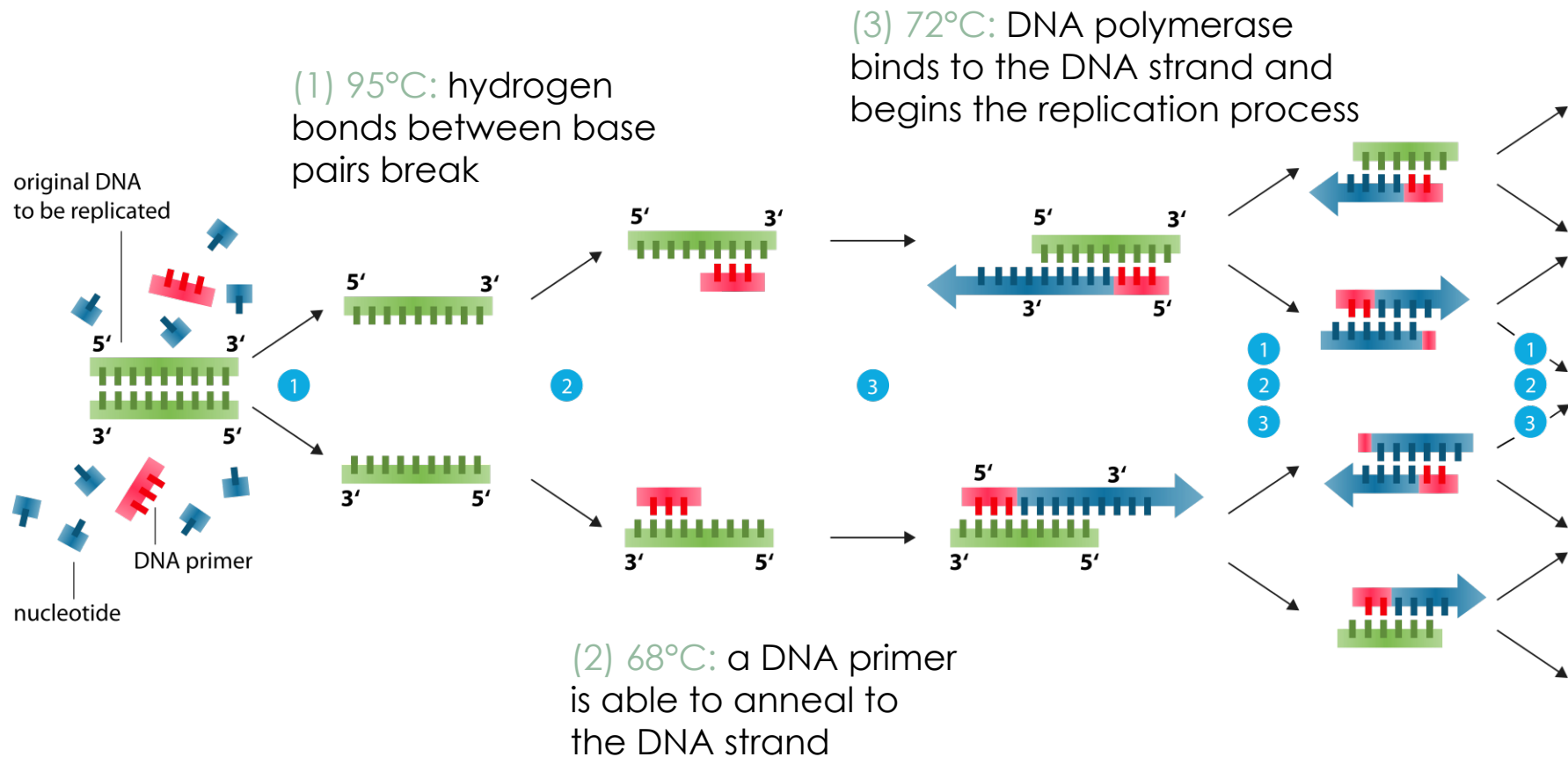
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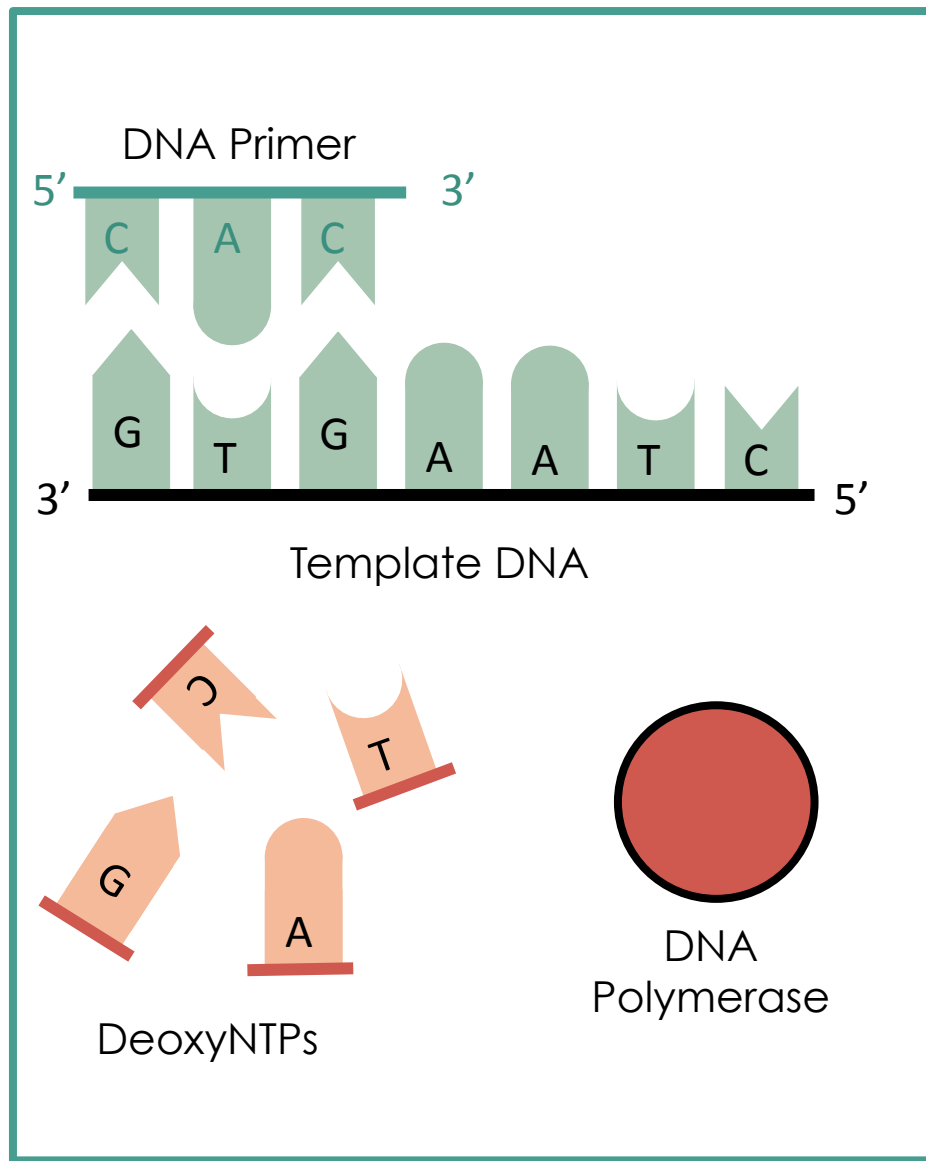


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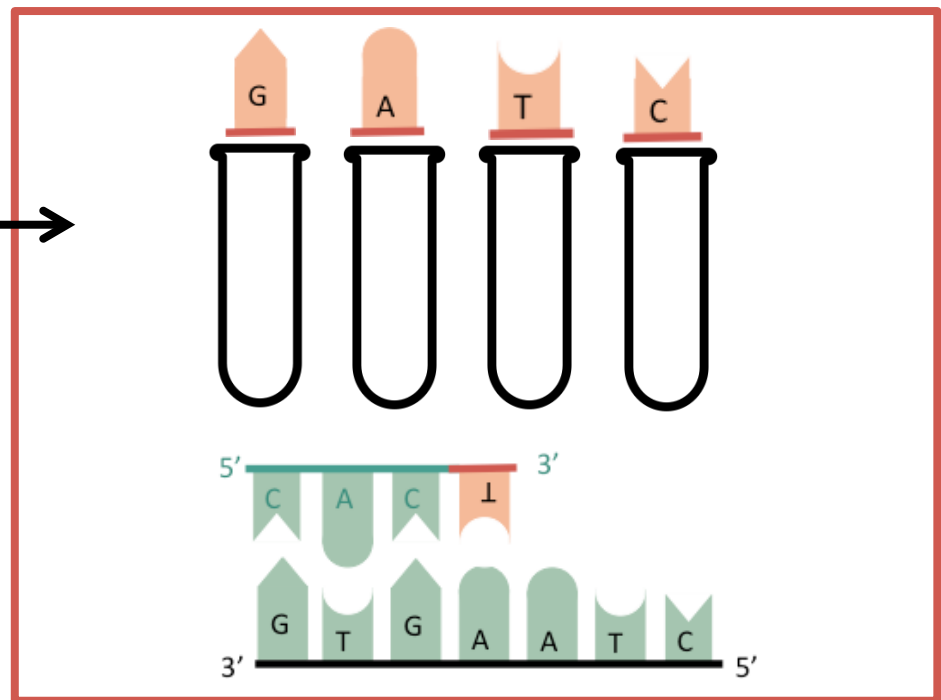
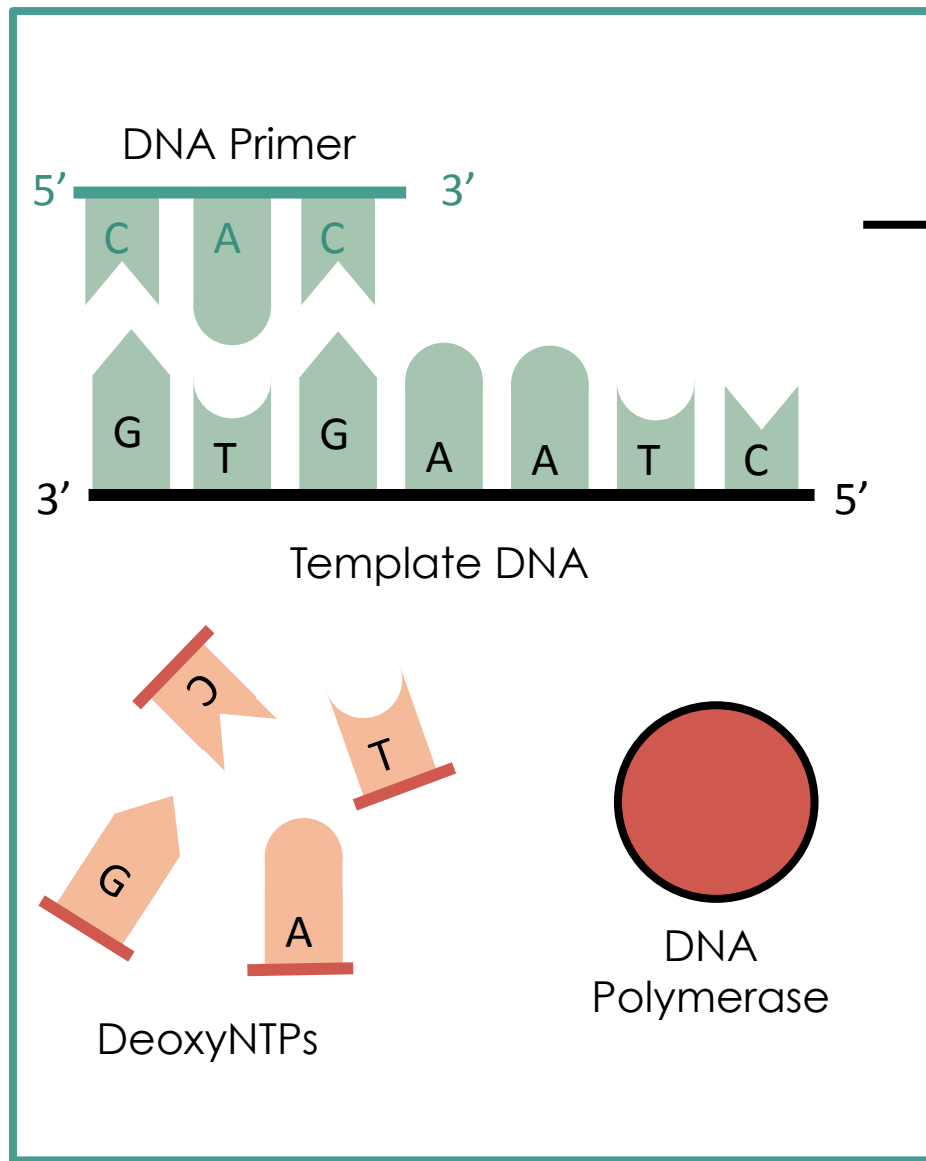
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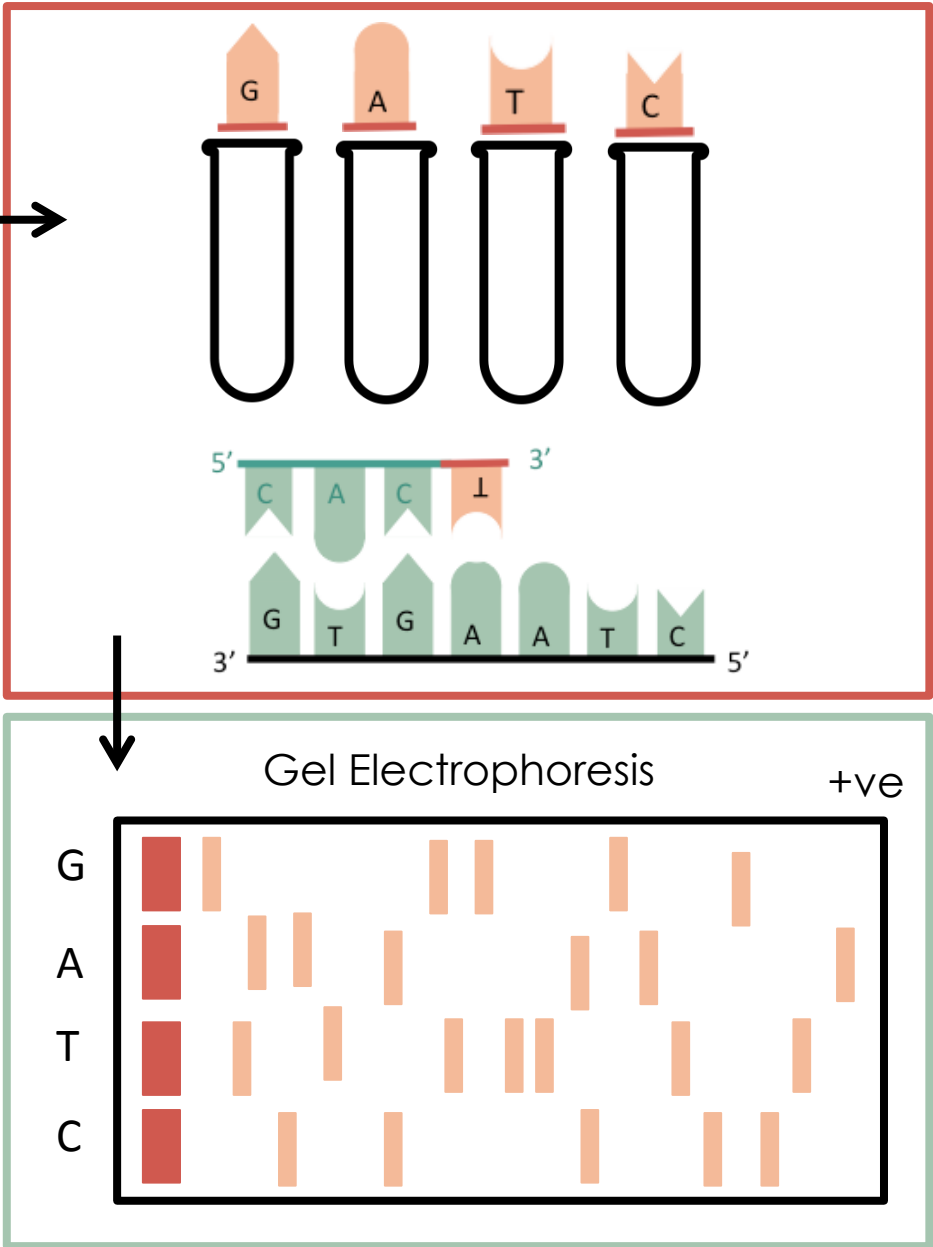
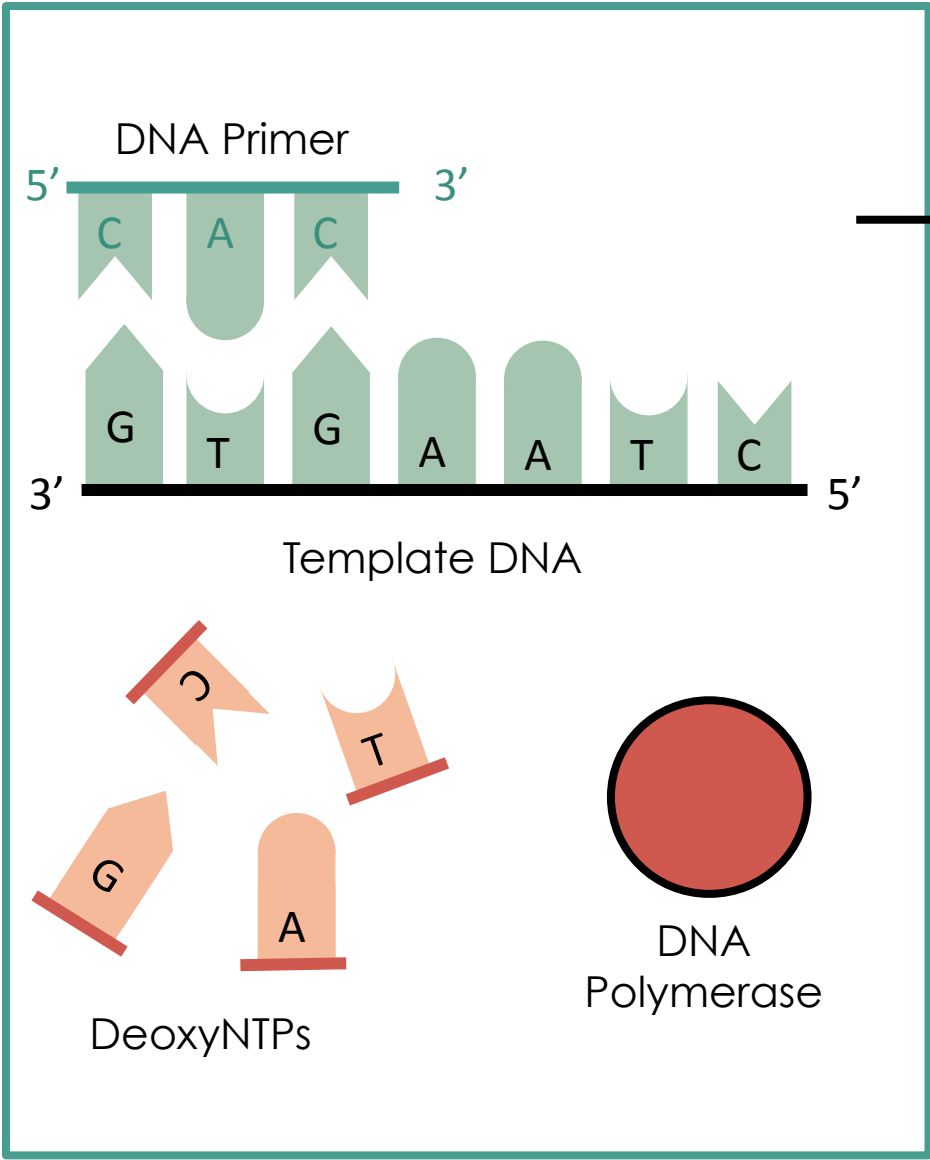


Sequencing Genes



Sequencing Genes





Why is Synthetic Biology Important?

Problems

Solutions

Food
Shortage



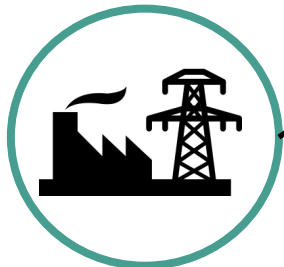
Climate
Change



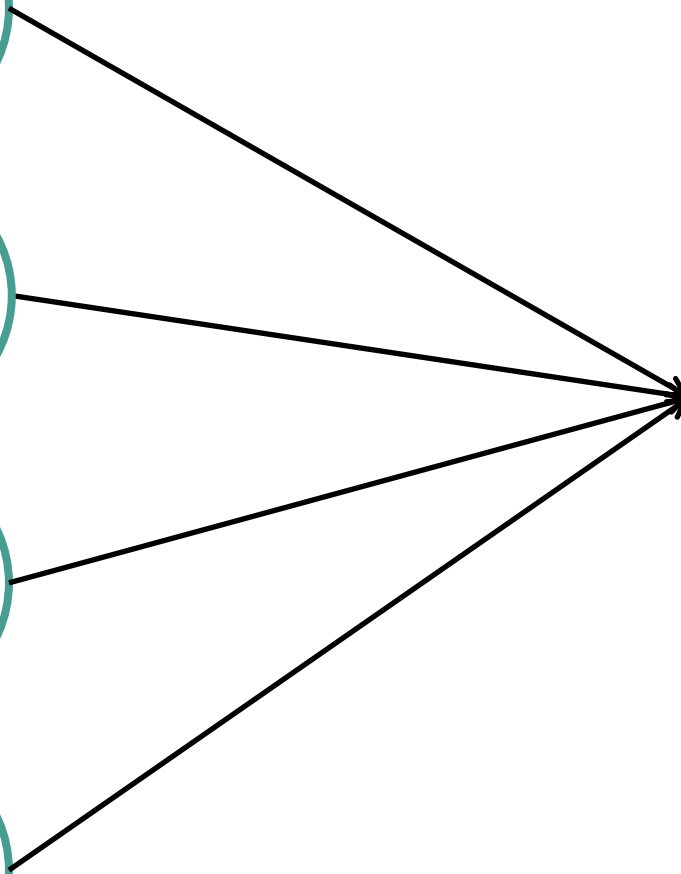
Need for
New
Medicines



Finite
Power
Supply



Synthetic
Biology



Finite Power Supply: Biofuels

What are they?

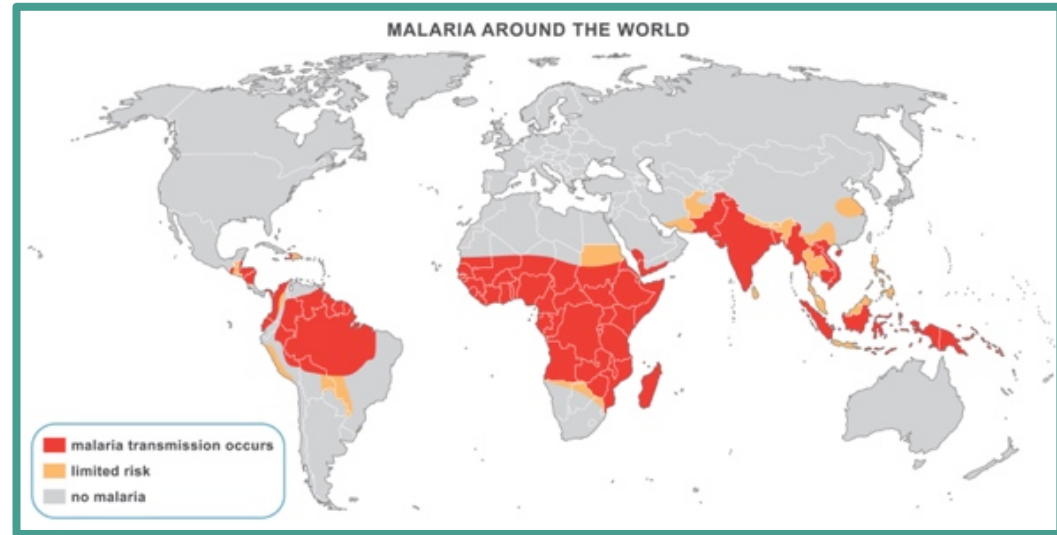
Fuels extracted from plants and crops.



1. Renewable
2. Reduce Greenhouse Gases
3. Less Pollution
4. Lower Cost

Need for New Medicines: Artemisinin

- In 2008 there were 247 million cases of malaria, with 1 million resulting in death (World Health Organisation).
- Naturally artemisinin is produced by a plant, cultivated by farmers. This is unpredictable based on crop success.



Metabolic engineering provided an alternative method: a non-native pathway was created in yeast which contained the genes to make the drug.

Material Production: Web Spinning Goats



- Spider silk is a **very strong** material, stronger than kevlar.
- This and its **flexibility** allow for its use in many potential applications. E.g. **artificial ligaments**.
- Spiders cannot be farmed, they just eat one another.

By combining genes from the spider's DNA and goat embryos it is possible for normal goats to **produce the spider silk protein in their milk**. This is then extracted and spun into the silk.



iGEM: Cambridge 2009



E. chromi:
personalized disease
monitoring



iGEM: Imperial 2014

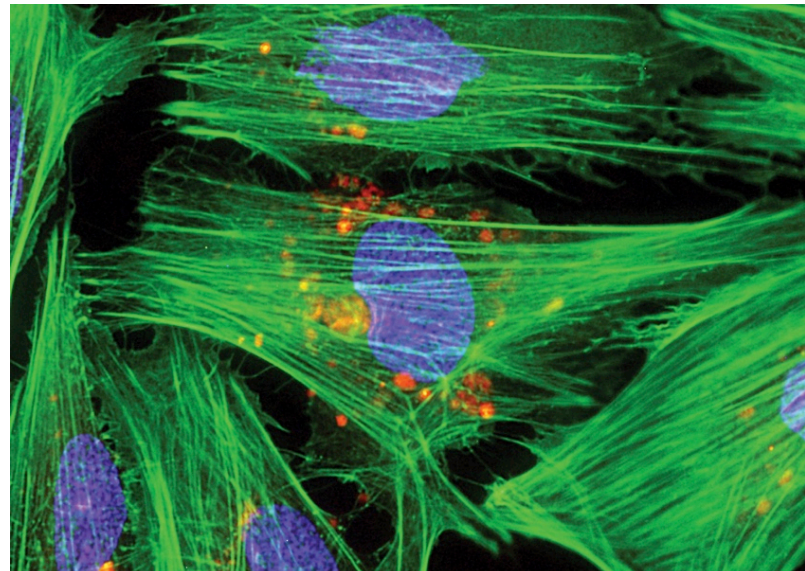
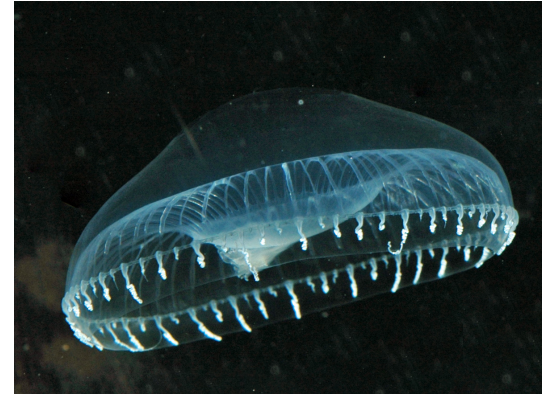


Aqualose: bacterial
cellulose



iGEM: Cambridge 2015

OpenScope: low-cost
fluorescence microscope



Cambridge 2015: OpenScope

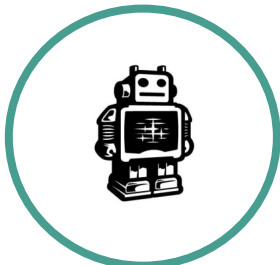
Low cost



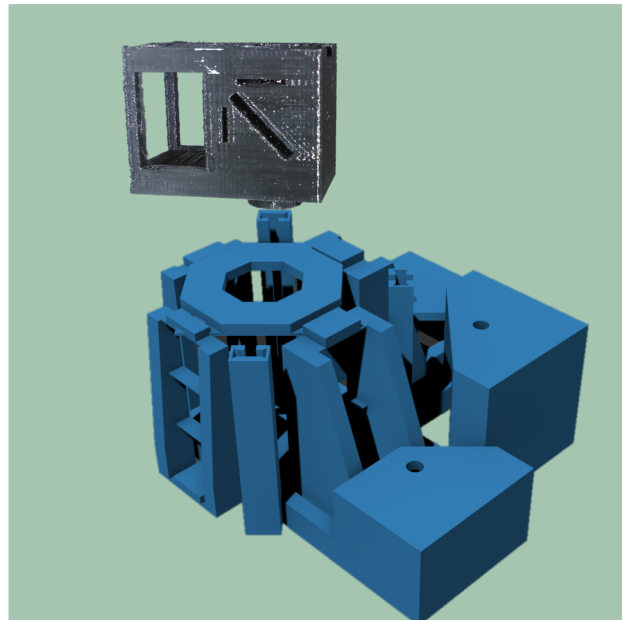
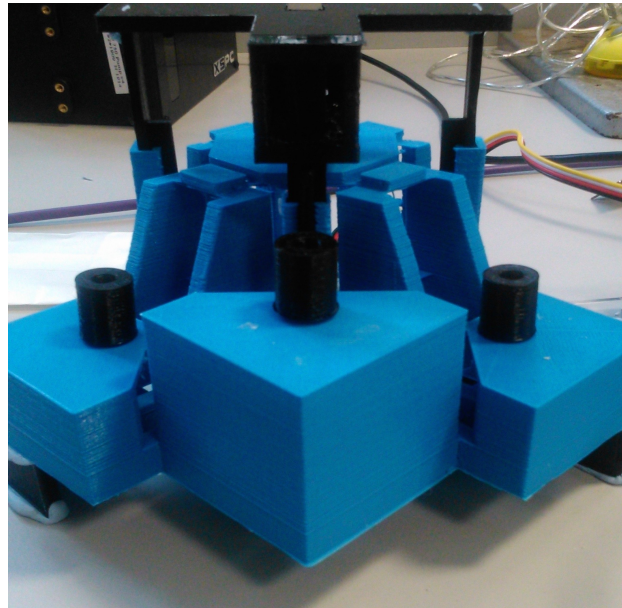
Portable



3D Printed



Easy to build/replicate



Education



Academics



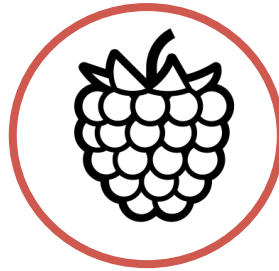
Developing Countries



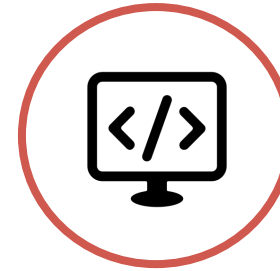
Cambridge 2015: MicroMaps



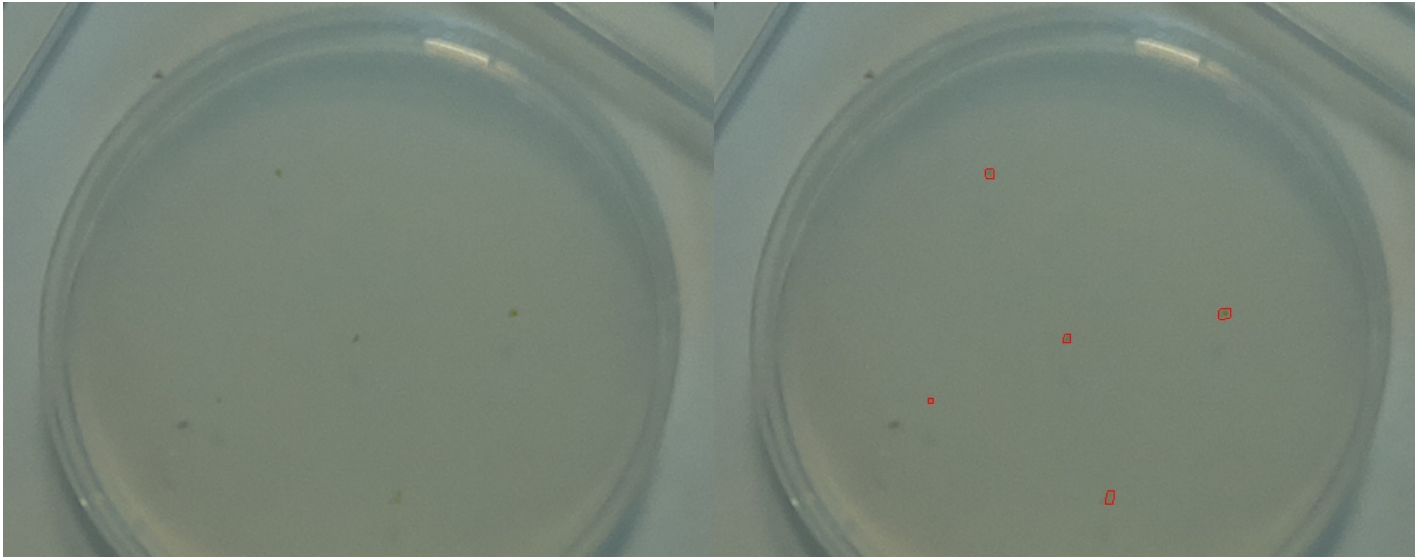
Remote Access



Raspberry Pi Control



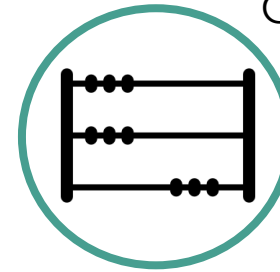
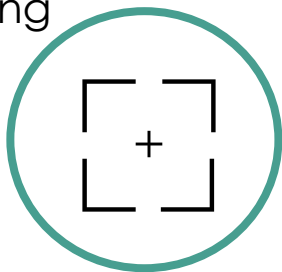
Programmable



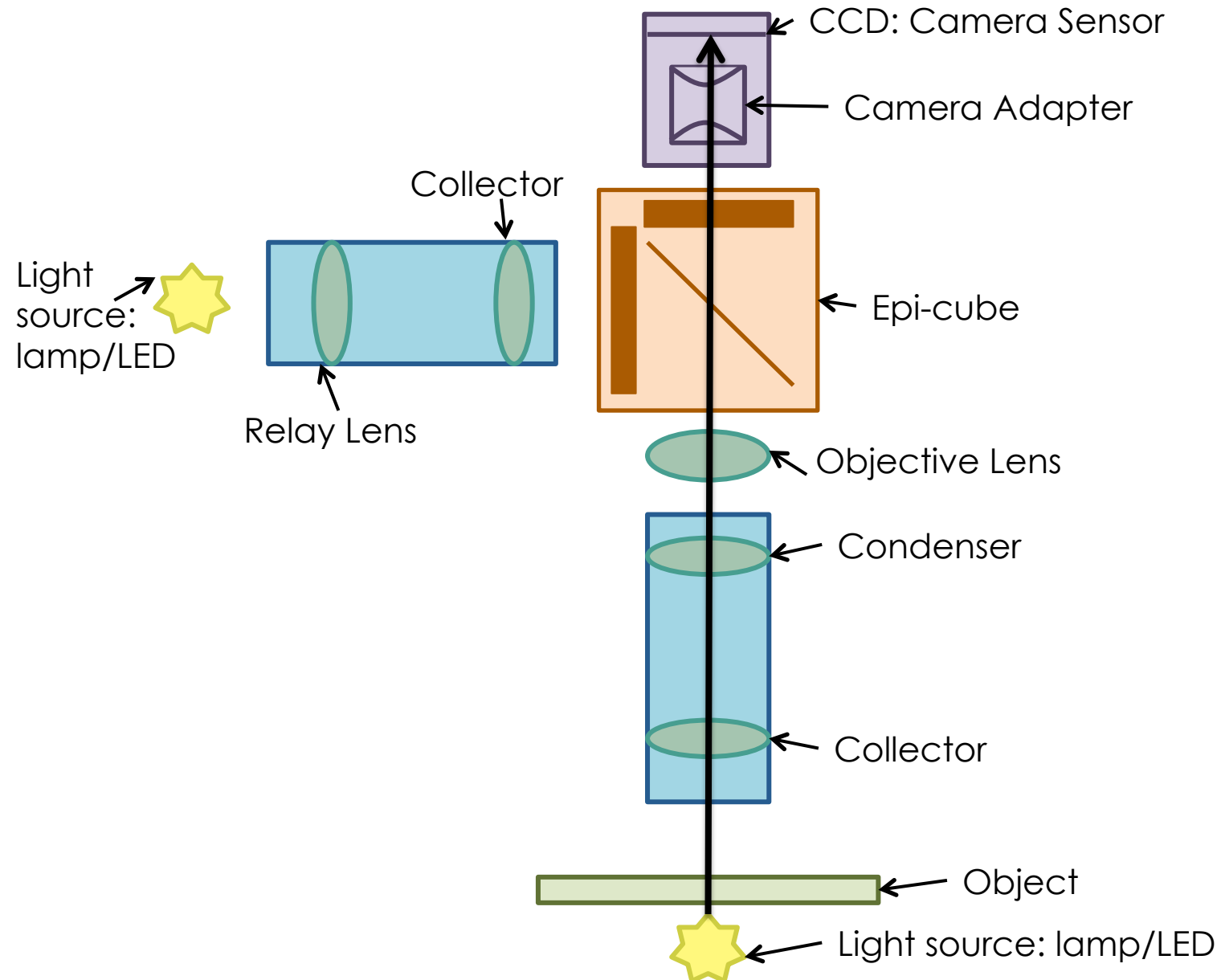
Automated
Cell Screening

Time Lapse Imaging

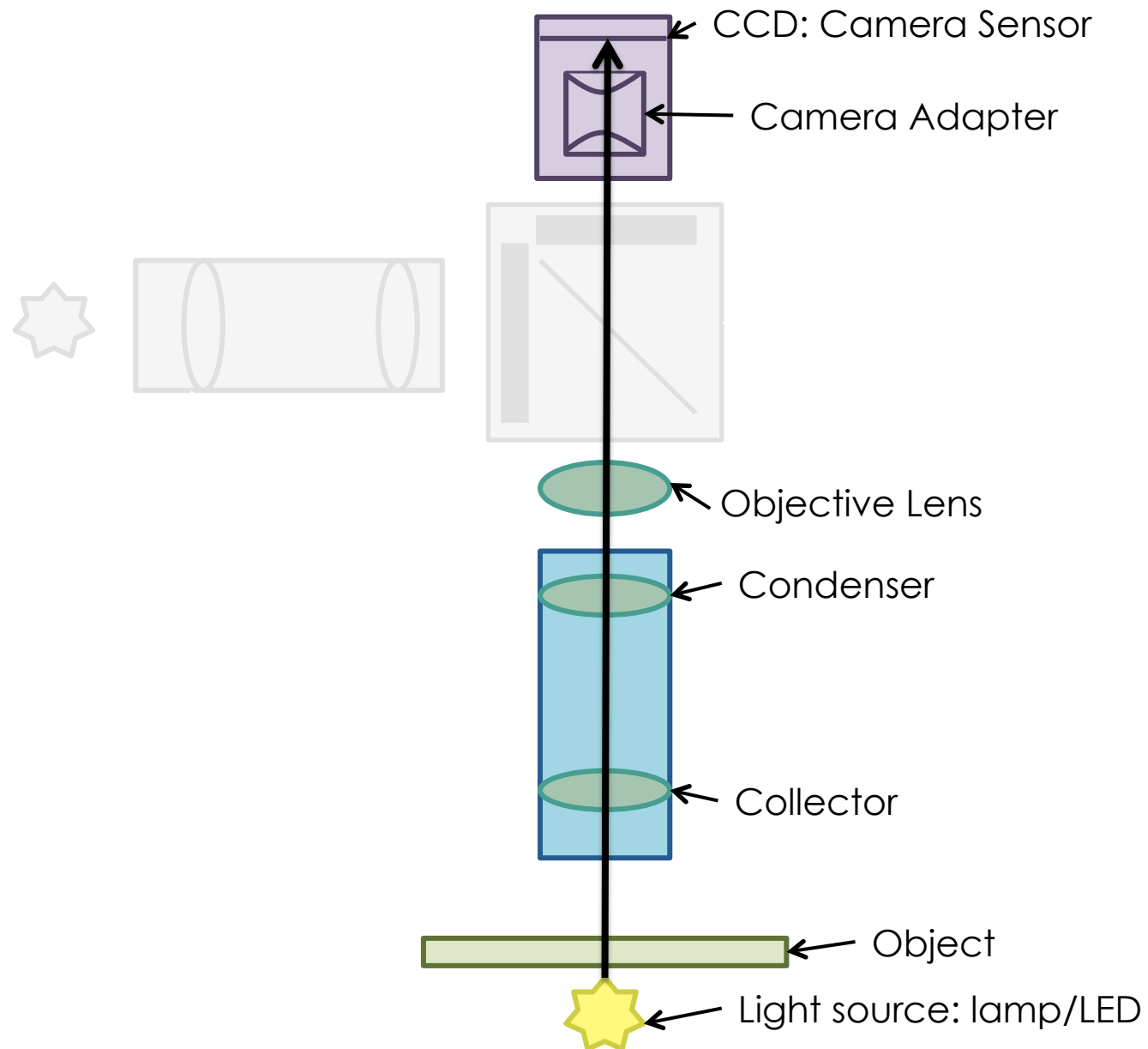
Cell
Counting



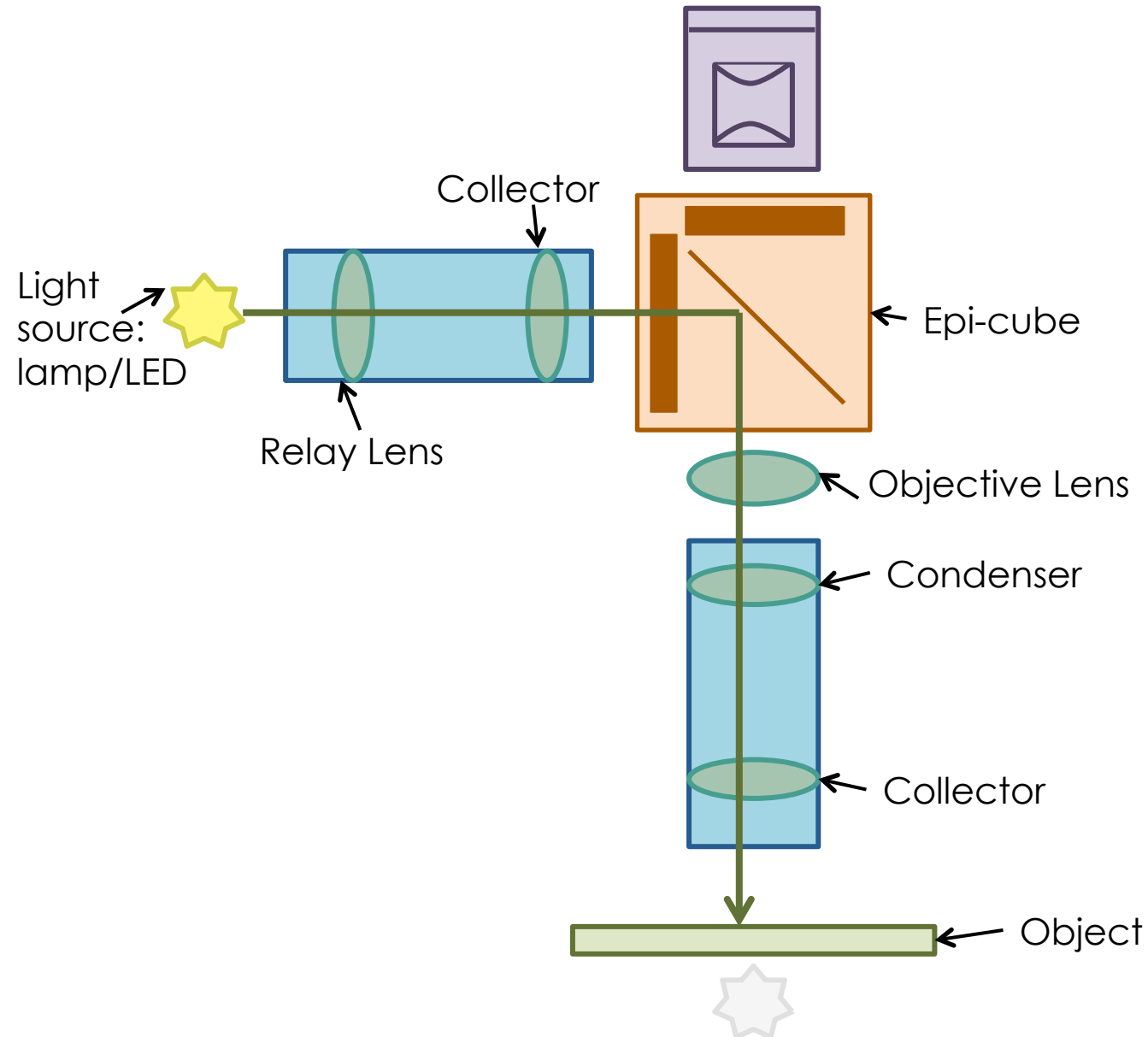
How do microscopes work?



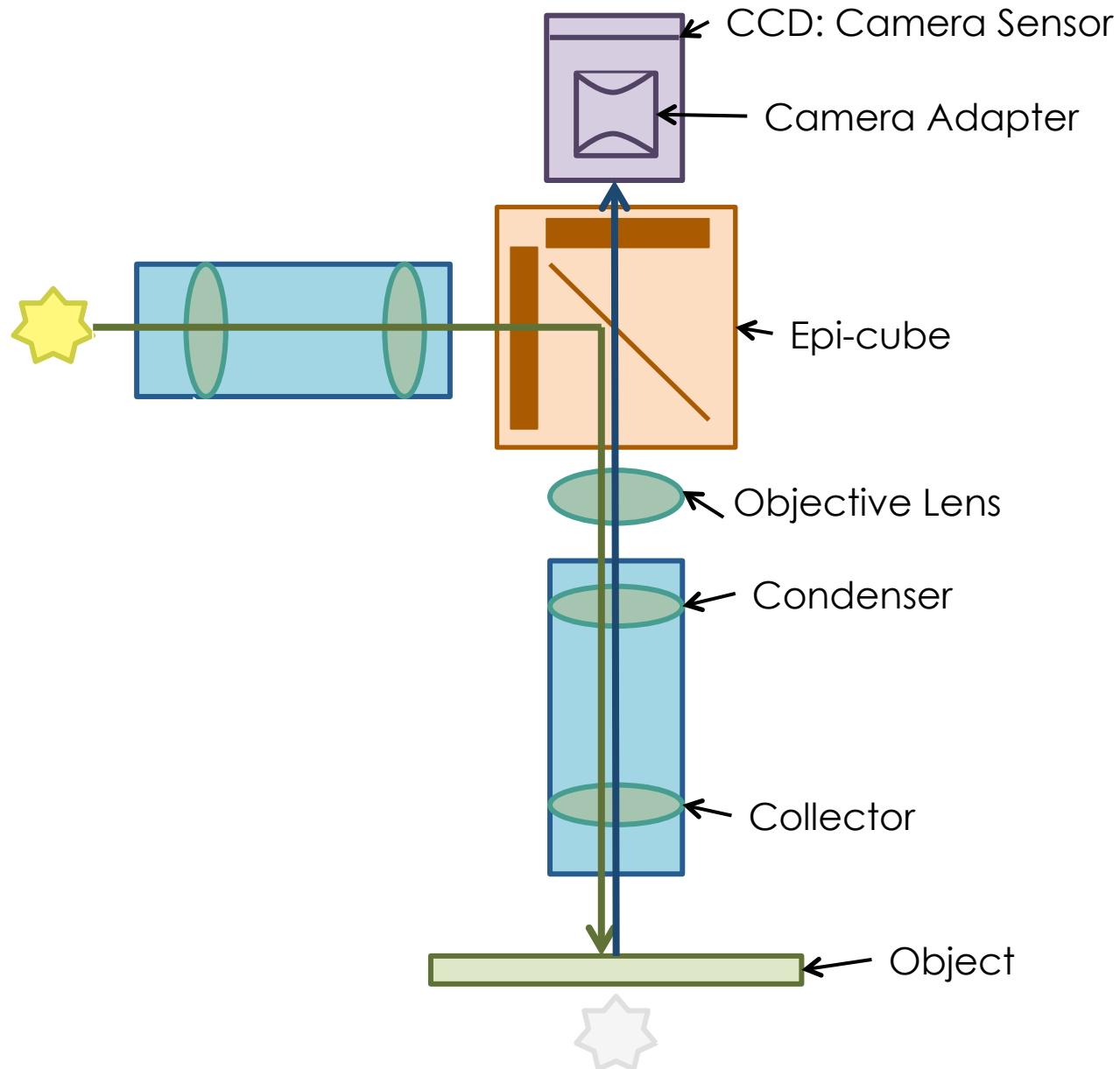
Microscope: bright-field



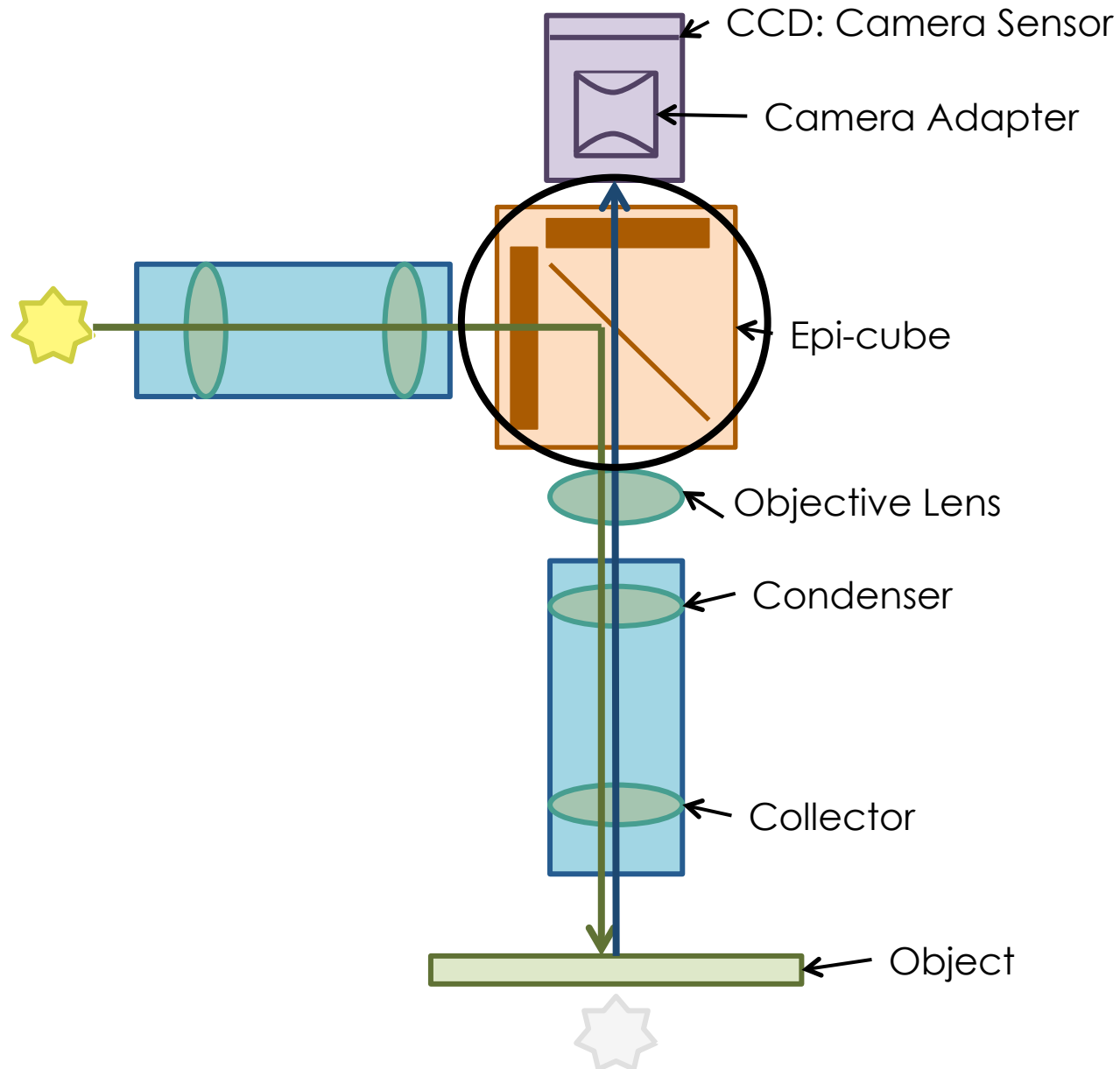
Microscope: epi-fluorescence



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Microscope: epi-fluorescence



How does epi-fluorescence Work?

Excitation Filter

Allows wavelengths of light to be transmitted that will then excite the sample.



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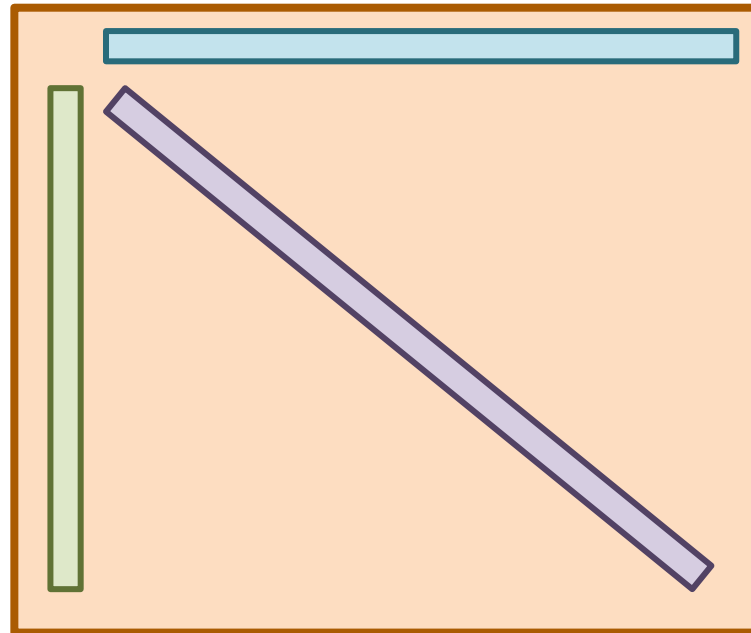
Emission Filter

Allows wavelengths of light to be transmitted that will be detected by the camera sensor.

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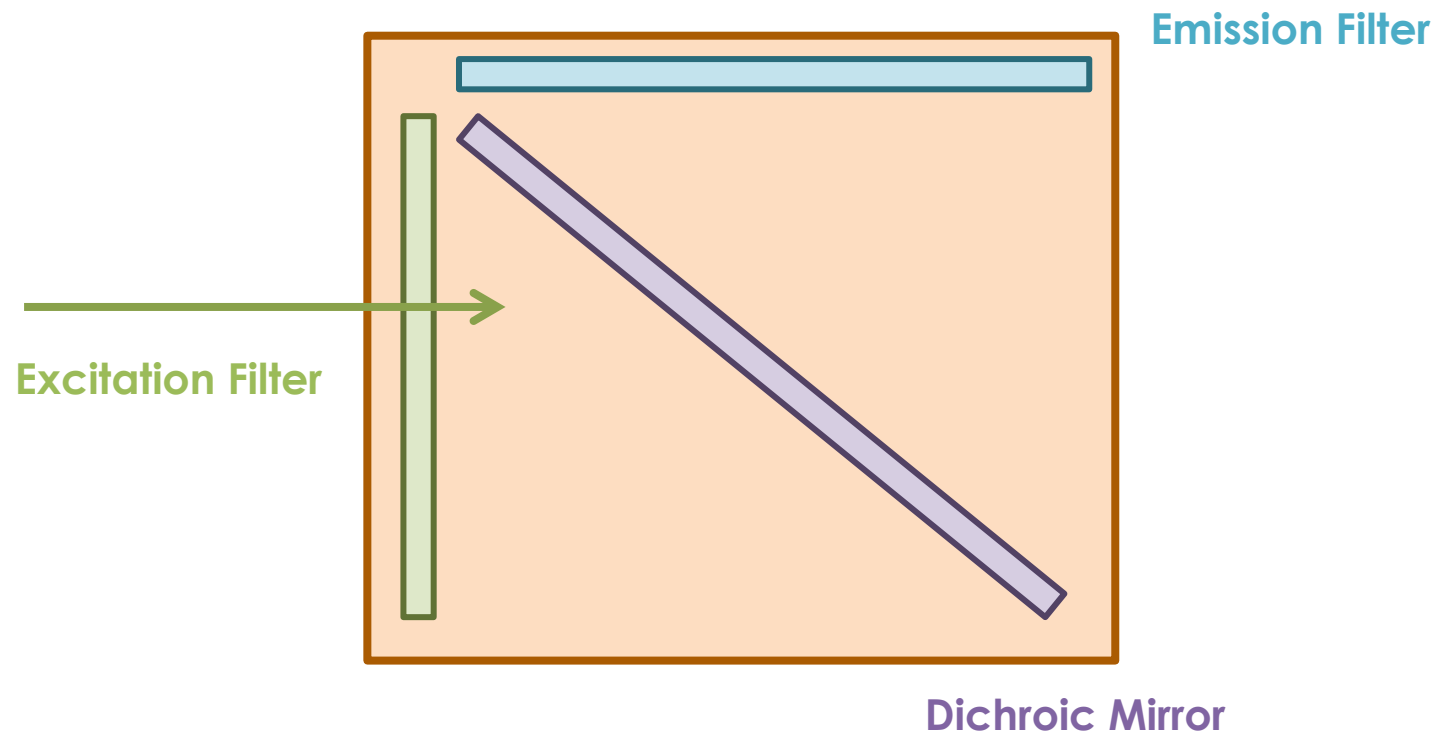
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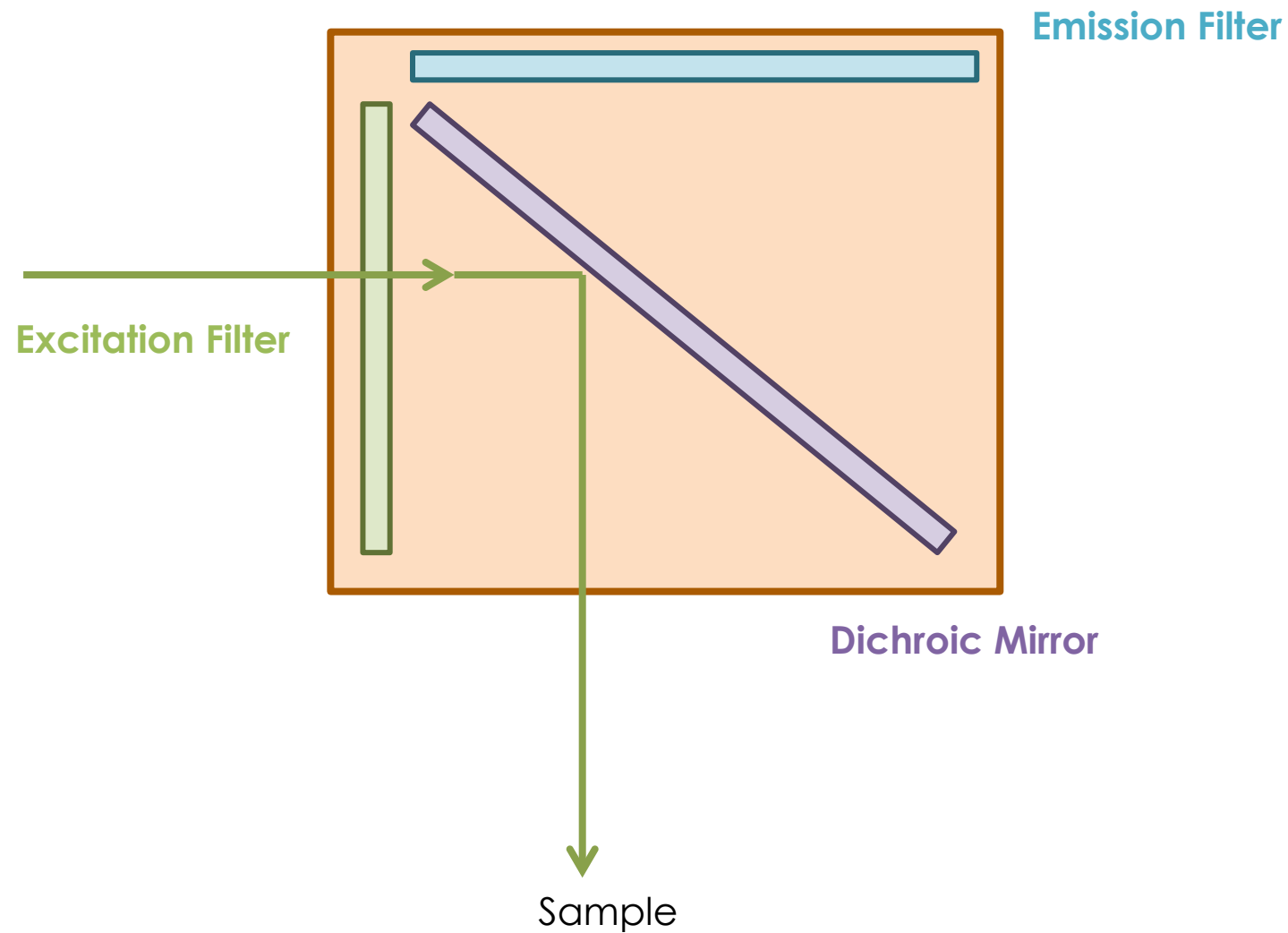
Dichroic Mirror

Positioned at a 45° angle. It selectively transmits and reflects a certain range of light colours/wavelengths.

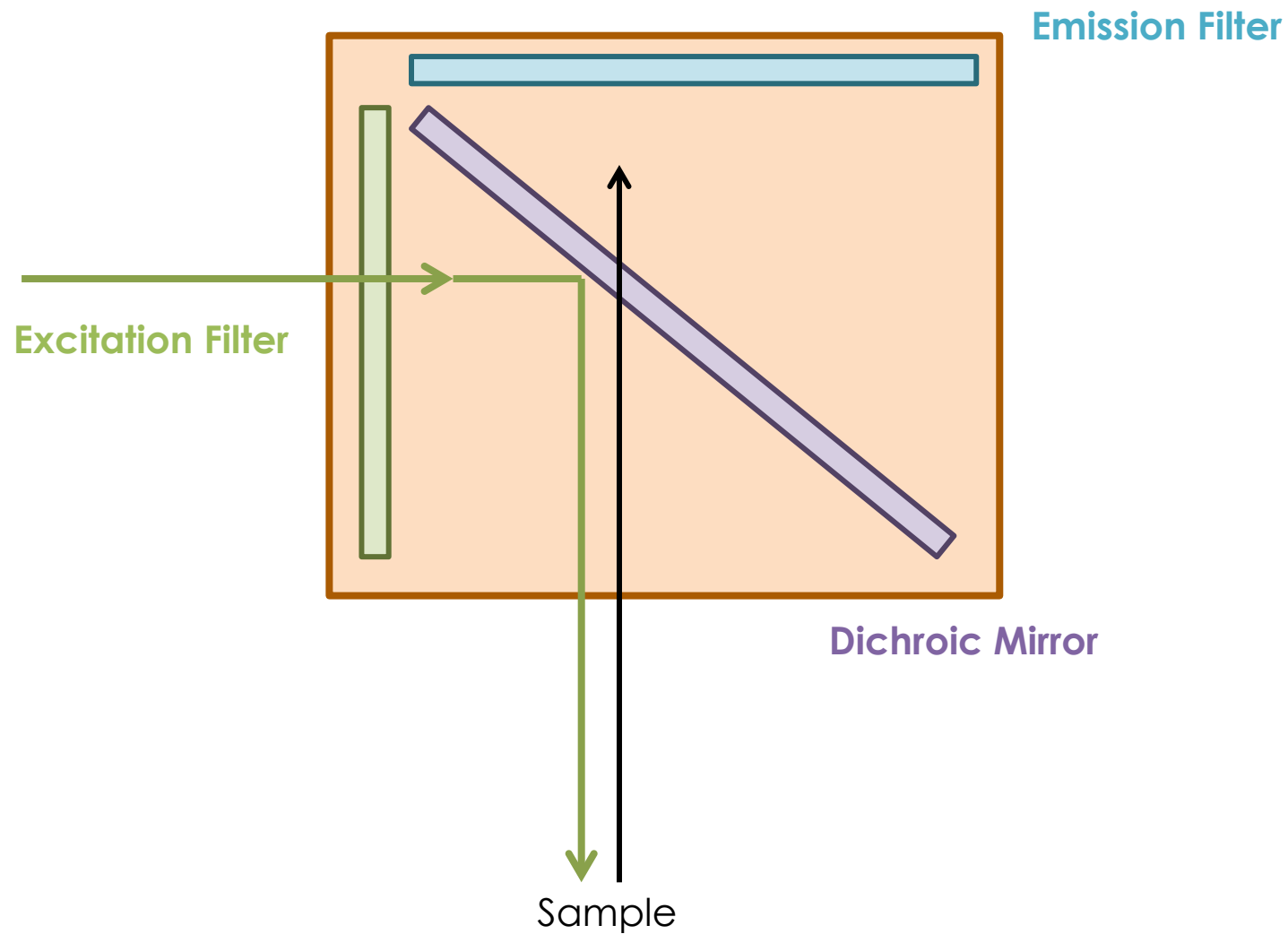
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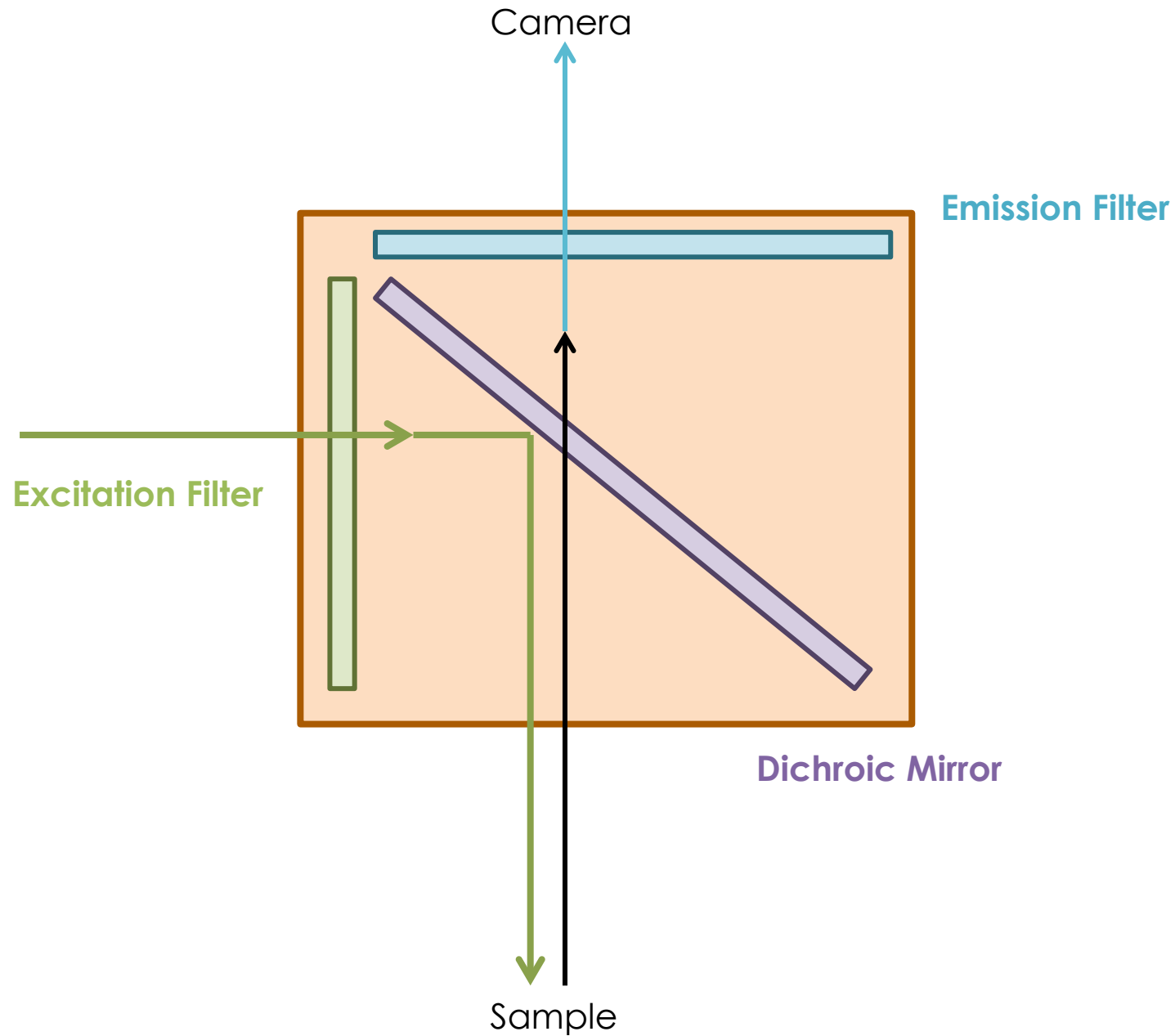
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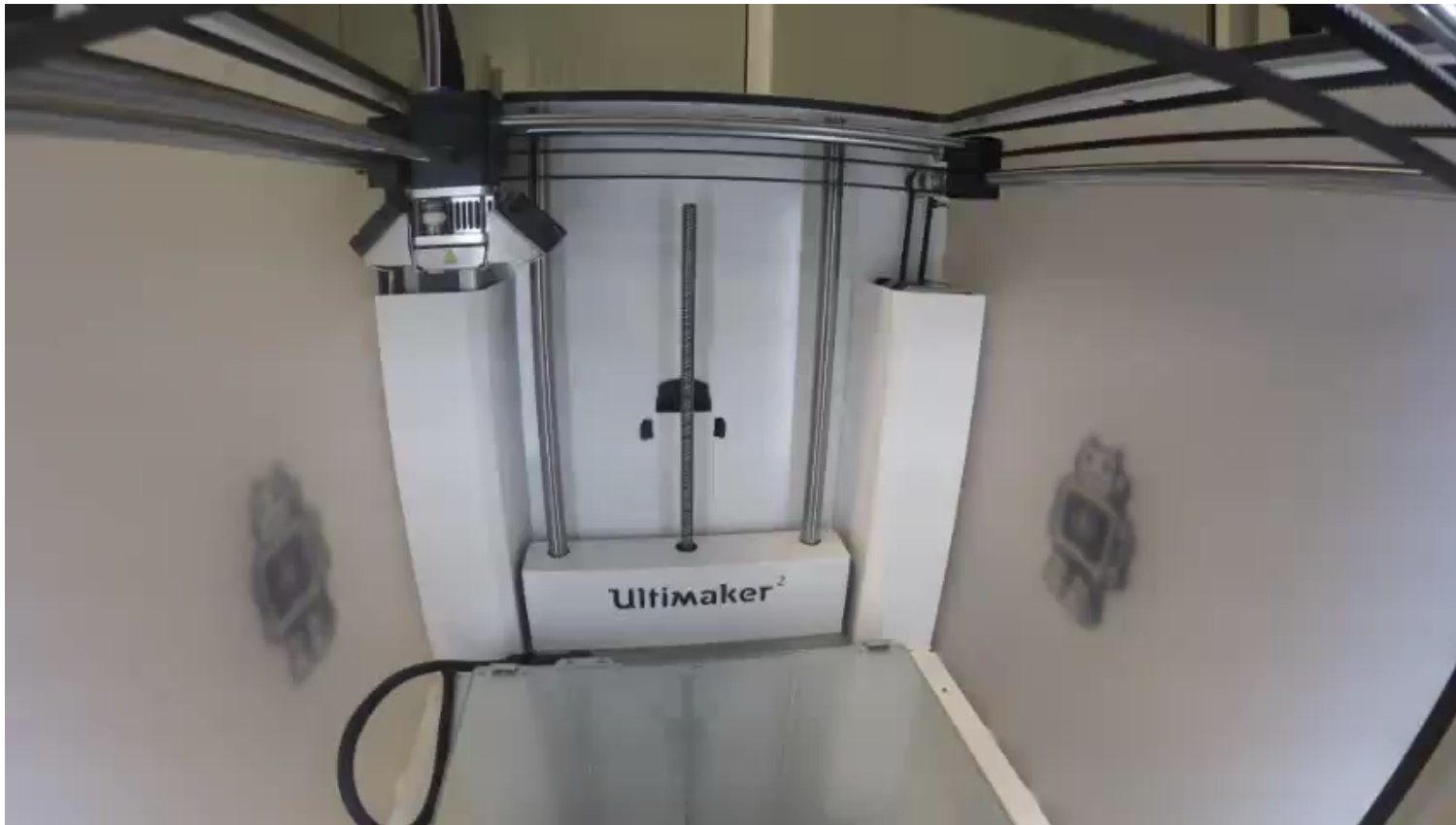
How does epi-fluorescence Work?



How does epi-fluorescence Work?



3D Printing



Thanks for your attention

Do you have any questions?